Effect of De-Icing Salts on the Corrosion of Automobiles

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● THE use of salt on roads and streets has become a controversial subject primarily in relation to the increase in the amount of corrosion to automobiles, conduits and other equipment made of ferrous metals. However, by far, the greater number of complaints concern the rusting of automobiles.

The job of the highway engineer is to keep the roads open to traffic, and there is no argument against the fact that icy roads play havoc with the orderly movement of cars and commercial vehicles.

This nation has become dependent upon the motor vehicle for the movement of people, materials, food stuff and other perishables, and any interference with the rapid transfer from origin to destination can bring about large monetary losses.

For example, Glenn C. Richards, General Superintendent of the Department of Public Works of the City of Detroit has given the following estimates as to the savings resulting from the use of salt on the streets of Detroit: (a) Loss of work caused by people getting to work late because of icy conditions. Based on the average person being one-half hour late, the total loss to Detroit employers is $1,589,000 per icy day or approximately $55,000,000 per year (approx 35 storms per year). (b) Loss to cartage and traveling companies, due to their being able to move at half their regular speed, $2,000,000 or $7,000,000 per year. (c) Loss in business — sale of merchandise — customers unable to get to stores, which do about half their regular volume, $766,000 per day or $426,000,000 per year. (d) Department of Street Railways — loss in income, $67,000 per day or $2,300,000 per year.

Other items might be included which would bring the total to over $100,000,000 annually. As against this the cost of removing snow each year amounts to about $875,000, of which $300,000 is spent for salt.

The foregoing figures do not include the cost of accidents which can and do bring injury and even death to drivers, passengers and pedestrians.

It can be seen that it is essential and even imperative that something be done to remove snow and ice, or at least treat it in some way so that traffic can move at as nearly a normal rate as possible.

A number of methods have been proposed and tried; scraping, plowing, the spreading of sand and cinders and the actual melting by the use of chemicals. All of these methods have disadvantages, as highway engineers well know. After numerous tests, made in many localities, the most widely accepted method is the spreading of rock salt.

Much has been written about the corrosive effect of salt on automobiles, but in no case are figures presented. One article could be quoted which stated that salt is not harmful to the finish on cars. While this is true, the statement is misleading. Salt is not harmful to the lacquers and enamels used on present day automobiles, but when the finish is broken in any way and the salt solution is allowed to reach the underlying metal then the trouble begins. Once the corrosion has started it continues to spread under the paint film, lifting it, exposing the rusted metal and causing the unsightly appearance to which the customer objects.

As far back as 1943 we began a series of surveys, in various cities in the United States, to study the performance in service of the finish used on our cars. This was in an effort to determine any weaknesses and to enable us to take corrective measures to improve their performance.

While we were continually making tests in the laboratory to study our finishing materials, these accelerated tests are never as conclusive as the actual behavior in the hands of the customer.

In these surveys we visited parking lots and examined not only cars built by General Motors, but competitors makes as well. While it was our original intention to be concerned only with the actual film failures, we soon became aware of the fact that corrosion

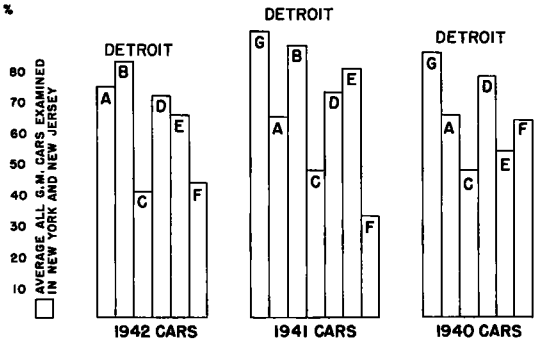

Figure 1. Percent of cars examined showing corrosion failure at fender welt joint - 1943.

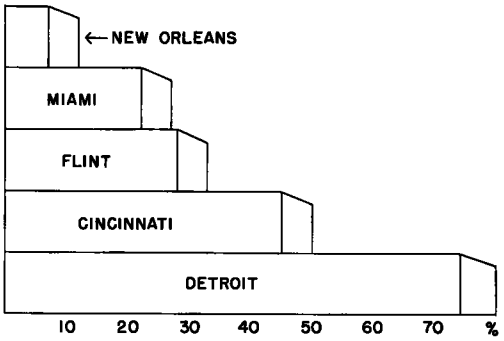

Figure 2. Percent of cars examined showing corrosion at fender welt joint - 1946.

was a problem that could not be overlooked. We, therefore, began to make notations of the number of cars that evidenced this type of failure at certain points on the cars that seemed to be vulnerable.

It soon became evident that the percent of cars showing corrosion failure was much higher in cities using salt than in the warmer climates where ice removal was not required.

In our first survey we examined cars in Detroit (where salt was used) and in several small communities in New York and New Jersey that did not use salt. The results are shown in Figure 1. Here we show the percent of cars examined that evidences corrosion at the fender welt joint. This is the juncture where the rear fender was attached to the body. Cars one, two and three years old were examined and the results in Detroit are compared with results in New York and New Jersey. The letters on the various blocks were used to designate different makes of cars.

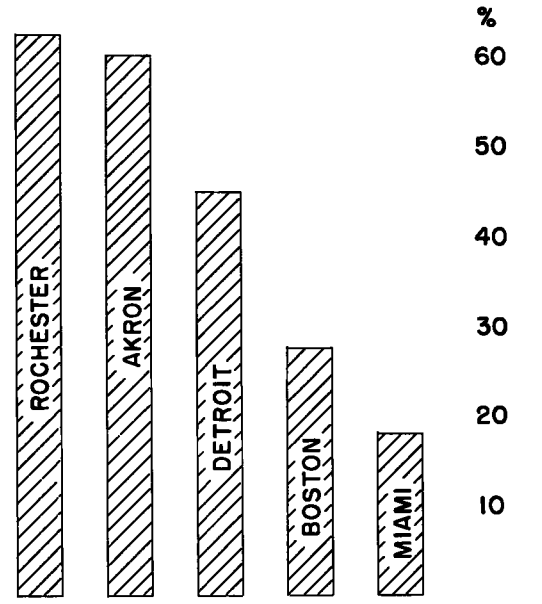

Figure 3. Effect of inhibitors used with salt spread on streets in Akron and Rochester, N.Y. No inhibitor used in Detroit, very little salt used in Boston, none in Miami. Failures at fender welt area - 1951.

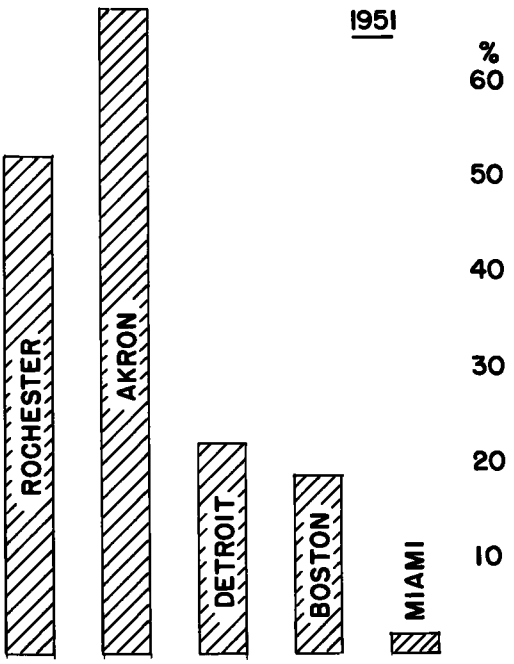

Figure 4. Effect of inhibitors used with salt spread on streets in Akron and Rochester, N.Y. No inhibitor used in Detroit, very little salt used in Boston, none in Miami. Failures at gravel deflector joint 1951.

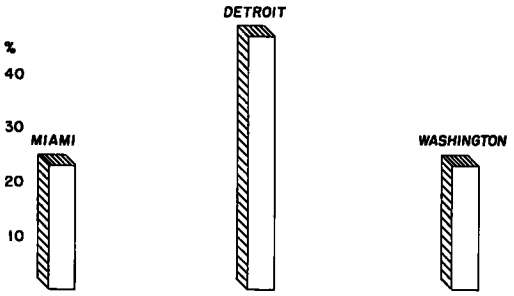

Figure 5. Corrosion failure at rear gravel deflector, all cars - 1953.

In Figure 2 are shown results of a survey made in 1946. Here again the fender welt joint was the area considered, and it can be seen that in Detroit, the only city where considerable salt was used, the incidence of corrosion was considerably higher.

From the evidence presented thus far it can readily be seen that corrosion is much more prevalent in cities where salt is used.

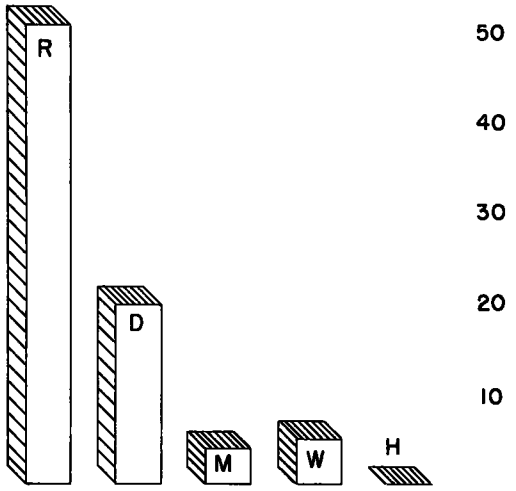

Figure 6. Effect of de-icing salt used on streets. Corrosion on front gravel deflector on one year old cars - Rochester, Miami, Washington, Houston and Detroit - 1955.

By the time the 1951 survey was undertaken there was much agitation and many were advocating the addition of so-called inhibitors to the salt spread on the streets. It is true that under certain carefully controlled conditions in the laboratory it can be shown that these inhibitors have some effect in reducing corrosion. For example, if you carefully clean and weigh two steel test panels, and then subject one to a salt solution and the other to a salt solution

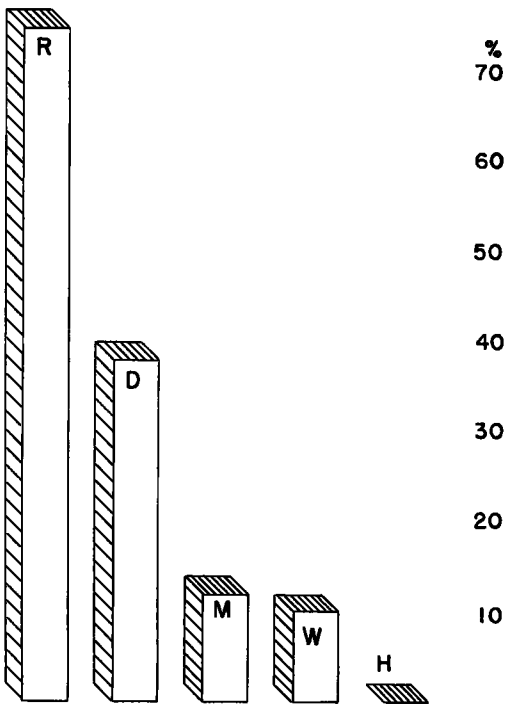

Figure 7. Effect of de-icing salt used on streets. Corrosion on front gravel deflector on two year old cars - Rochester, Miami, Washington, Houston and Detroit - 1955.

H-HOUSTON (No Salt)---------- 154 cars
W-WASHINGTON (No Salt)---------- 669 "
M-MIAMI (No Salt)---------- 745 "
D-DETROIT (Salt)---------- 937 "
R-ROCHESTER (Salt+ Inhibitor)--- 704 "

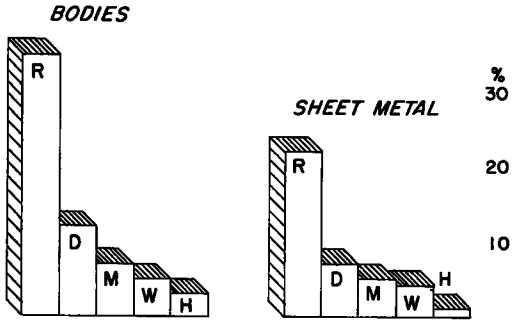

Figure 8. Effect of de-icing salt used on streets. Corrosion at gravel deflector joint on one year old cars - 1955.

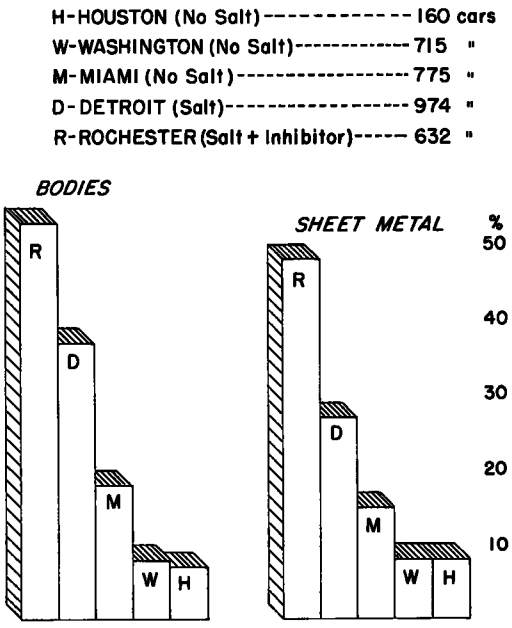

Figure 9. Effect of de-icing salt used on streets. Corrosion at gravel deflector joint on two year old cars - 1955.

containing an inhibitor and carefully control the ratio of inhibitor to salt, the one exposed to the straight salt solution will lose a little more weight than the other.

However, we believe this to be of little interest to the car owner. He is concerned only with the appearance of rust at any point on his car. At this time we included in our survey Akron and Rochester where inhibitors were being used at that time. The observations made in these two cities were then compared with those obtained in Detroit, where salt without inhibitor was used. We also included Boston, which used less salt than Detroit and Miami where, obviously, no salt was used. The percent of cars showing corrosion at the fender welt area in these four cities are shown in Figure 3.

At the same time we collected data on failures at the gravel deflector joint. The gravel deflector is the horizontal piece between the body and the rear bumper. These results are shown in Figure 4.

Results of the 1953 survey which included Miami, Washington and Detroit are shown in Figure 5 and again in Detroit, where salt is used, the percent of cars showing corrosion at the gravel deflector is much higher.

In the 1955 survey observations were made in Detroit, Miami, Washington, Houston and Rochester with the latter being the only city where an inhibitor was used with the salt. The percent of one year old cars examined that showed corrosion on the front gravel deflector is shown in Figure 6. To show how this type of corrosion increases as the car ages the results on two year old cars is shown in Figure 7.

The amount of corrosion observed in the 1955 survey at the rear gravel deflector joint, both on the body and the deflector itself, is shown for one year old cars in Figure 8 and for two year old cars in Figure 9.

It is true that the severity of conditions varies from year to year and from city to city. This makes comparison open to some criticism. However, it is believed that since repeated surveys continue to show the same results there is little to be said from the car owners viewpoint in favor of the use of inhibitors.

Automobile manufacturers are aware of the problem. They realize that salt is an accelerator of corrosion, but they also know that its use on the streets helps to prevent injury and death to their potential customers. They are also keenly interested in the development of inhibitors used with salt that would reduce the amount of corrosion. By changes in design such as the elimination of the fender welt joint and the gravel deflector and by improvements in protective coatings, they hope to minimize the susceptibility to corrosion.